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With the Author's Compliments.



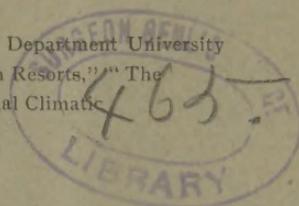
Tuberculin. ♦ ♦

The Value and Limitation of its Use in Consumption.

BY

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TUBERCULIN.

THE VALUE AND LIMITATION OF ITS USE IN CONSUMPTION.

I assume that no apology is necessary for my changing the subject of this paper from the Surgical Treatment of Lung Cavities to the discussion of Koch's lymph; because of late my mind and opportunities have been turned in the latter direction. Besides, my professional brothers expect some report of my investigations of the great German scientist's new remedy, and now and here are the best time and place for it. Now, because time enough has elapsed for the expression of a great variety of opinions, and here, because no *symposium* on consumption is complete without a consideration of this recent invention for its amelioration.

The questions which to my mind need most to be answered are.

1. Was the description given us of the composition of Koch's lymph sufficient for our gaining full knowledge as to its uses?
2. Were the rules laid down by the author adequate and complete enough for the use of so powerful an agent?
3. Is the knowledge of tuberculosis sufficient, or are the means and facility of its diagnosis adequate among the average of medical men for their use of tuberculin, as proposed by Koch, without a considerable chance of damaging the patients, as much as they would benefit them?



I have arranged these questions purposely that I might answer them as I do, with a decided No. It must then follow that this is not yet a remedy to be indiscriminately sold by druggists, and generally used by all sorts of doctors.

The much to be desired time will come, if this remedy is not too soon consigned to oblivion, as it was at first placed on the top of the Mountain of Hope, that the knowledge of tuberculin and of tuberculosis likewise, will be adequate to satisfy a critical mind. But that time is not yet.

Nevertheless, with all these doubts and suggested limitations, the use of tuberculin, though unconsciously faulty, is not to be forbidden, if we can show that we are running only a ten to twenty per cent. chance of danger for the purpose of a thirty to sixty per cent. chance of benefit. The reason for this discussion is thus apparent, that through the process of exclusion, conditions only favorable to the use of tuberculin may obtain, and the percentage of danger be reduced to the minimum.

This criticism of the German professor's methods must not be considered as an under valuation of that scientist's true worth. Robert Koch stands to-day without a living peer in the great and growing profession of medicine, for he has originated more for scientific advance than any two men living. He has not only discovered the bacillus of tubercle so that physicians all over the world could easily demonstrate it as an essential feature in every tuberculosis, but in a few years thereafter he has produced a fluid which wars against the *habitat* of that germ, thus tending to eliminate its consequent disease. When we reflect that tuberculosis exterminates more of

the human race than any other disease under the sun—that is, ever since Jenner's vaccine virus "knocked out" small pox,—we say all honor to Robert Koch, the greatest physician of the age.

We would, if possible, find out the inadequacies or mistakes in Prof. Koch's procedure, that the perfection of his great discovery might be brought nearer to hand. For I believe that rightly directed criticism will do much to clear away the doubt and prejudice which largely pervades the professional mind as to this means of cure.

Let me then consider the questions previously propounded, and see why they should be answered in the negative. I will use the cases I have experimented on for purposes of corroboration or reference, and try not to burden your minds or patience too much with their many details. We shall confine our attention wholly to pulmonary cases. These cases have been twenty in number. Numbers one to five of these, most people would call cured. I do not yet claim that term as applicable, yet they are probably better off than in a state of arrest, because the tuberculosis has been in a process of elimination. These twenty cases were serious enough; distinctly tubercular, yet only two of them acutely so.

Nos. 1, 2 and 3 were third stage cases, with both lungs more or less affected, while Nos. 2 and 3 had the dreaded laryngeal complication.

No. 4 is interesting, as showing the diagnostic power of tuberculin. This was a case of fibrosis chiefly, evidently tubercular when he came to Colorado for his health three years previous. In March, 1891, his disease was apparently fully arrested, through the fibroid process and rarefied air. The question then arose, could he go back

East to live? I obtained from his parents permission to use the tuberculin to learn if latent tuberculosis remained. I was much surprised to find a considerable local reaction in the right infra-scapular space, where previous to the first injection I had not noticed anything abnormal. This reaction was over an area two by three or more inches, and was accompanied by the characteristic febrile rise to 101°, and the appearance of bacilli in his sputum, (four to the field) which had not been found by a previous microscopic examination. This reaction, which was marked after 2, 4 and 6 mgs., wore off with the lessening of fever as larger doses were reached. Finally there was no reaction after 20 mgs., and I consented to his return to Massachusetts after a 30 mg. dose and about six weeks treatment. The characteristic rough breathing in the rear base of the right lung had moderated, assuming the slightly bronchial character usual in high altitudes in an arrested fibroid lung.

Case 5, of my list, is to me very interesting, because it shows the undoubted agency of climate and lung ventilation in the cure, as well as the rapidity and ease with which his system took the tuberculin. Mr. F. T. P., age 27, a lawyer from Toledo, Ohio. In January, 1890, had had la grippe, followed by weakness, night sweats, cough and loss of 15 pounds in weight. In March, went to Asheville, N. C. Was thin and had decided p. m. hectic there for some time. Began to gain flesh in October. Arrived in Colorado October 18th, weight at least in summer 133 pounds, October 20, 150 pounds. Temperature ranged between 98° morning and 100° evening. Spirometrical record 240. Manometer 85 M. M. Expansion 33 and 36. Sputum yellow, one-half cup chiefly

mornings. Depression, moist rales on coughing, and almost "cracked metal" on stethoscopic percussion below right clavicle. Waivey and broncho vesicular respiration in left inframammary and lower axillary. All showing softening (2d stage) at right apex and arrested fibroid process at base of left lung.

May 7, after spending the winter, much out of doors, in Colorado Springs, all the physical signs were found to be improved. Expectoration less one-third cup in 24 hours. Expansion increased 1 inch, $32\frac{1}{2}$ and $36\frac{1}{2}$. Fewer rales at right apex. Bacilli in sputum, some slight probably compensative emphysema in lower half right lung.

May 15, began tuberculin injections. Bacilli five to field, no general reactions (*i. e.*, no fever), but slight local reactions shown by physical signs, so a rapid increase of dose was allowable, *i. e.*, nearly doubling every other day.

May 23, after 10 mg.; thirty bacilli to field.

June 2, after 45 mg., three or four scattered bacilli to the field, but still with slight remaining indications of the effect of the tuberculin local reaction, the characteristic harsh breathing in right infra-clavicular and left infra-scapular regions. Pulse, respiration and temperature normal, expansion $32\frac{1}{2}$ and 37 inches. He declared he was well, and was bound to go home, to Toledo. I could not restrain him, and so with a parting 50 mg. "shot," let him go, with the advice that he return, work up to 80 mg., and then thoroughly establish his cure by camping in the mountains during the hot months of the summer. We shall see. A letter just received from him says he does not feel as well down in Ohio, and he may return. [Later, Jan. '92, writes that he thinks he is fully cured.] These

five cases have all lost the usual signs of tubercular state, have increased in vigor and no longer react to large doses of tuberculin, 30 to 50 mg. Their sputum, diminished to the minimum in quantity, shows only the remnant of the vanquished bacillary army which was making war on the organism, at the commencement of this treatment, four months ago.

Numbers 6, 7, and 8 are now under treatment, and will soon arrive at the favorable state of those previously mentioned. They are progressing evenly and finely, These are, No. 6, a lady from Greeley, with broncho-fibro-tuberculosis, having a very small softened or bronchietic spot in each lung, now completing a mid-way rest in the treatment at 30 mg. (Since graduated at 80 mg.)

No. 7, a tolerated third stage fibro-tubercular case, with large cavity in left apex, who has slowly reached 7 mg.; and No. 8, a more decidedly tubercular fibroid case, both lungs affected, with a bronchiectasis in the left and a softened spot on the right, and considerable dissemination of the fibroid process. He is now getting used to 1 and 2 mg. One mg. tuberculin was too much for this patient at first, and four lesser doses had to be given before the reaction satisfied me as sufficiently mild. Nos. 9 and 10, lately commenced a cautious or tentative plan of treatment, and are third stage cases progressing satisfactorily, but the final result is not yet in sight. No. 9 is a case of laryngeal phthisis, and a process of healing can already be noticed in a tubercular ulceration on the left side of the pharynx.

Nos. 11 to 14 inclusive have ceased treatment temporarily for reasons given. They were favorable cases,

however, and reached an average of 10 mg. for last treatment. These four were all third stage cases, the evidence of that advance being very positive with large cavity in one case, much less positive, and in a small space in the others. I cannot consistently, with my notions of truth, classify the consumptives we have to deal with in Colorado and put many in the *second* stage. If softening has occurred that is usually the end of it, and it is the result in the *third* stage with which we have to deal..

Of these four, Dr. ——, of Idaho Springs, reached 14 mg. and reacted slightly at that increase; lost his fever, and gained in strength and physical signs. The effect of the tuberculin in shrinking of affected lung tissue was manifest in his case. The highest reaction was 102° F. after 4 mg. March 8, he returned home to his practice, and continued the injections himself with beneficial effect.

Case 12.—N. J. F., a laborer, aged 30. Case of tremendous cavity in left lung reaching from clavicle to opposite left nipple, and lying on the anterior border of the lung. The regularity of his pulse 88, respiration 32, temperature 98° to 100 1-5°, and my confidence in his unexcitable, steady temperament, led me to give way to his determination to try the new "lymph" treatment. I was from March 13, to April 9, reaching 9 mg., and on April 26, reached the highest point, 18 mg., when a rest of ten days was taken.* Then I returned to 10 mg. at a dose, and was cautiously increasing from that point with favorable effect, when he was offered an opportunity to take charge of a squad of men working on a railroad. I believed that climate, out-door occupation and time were as important for him as the remaining chance of benefit

from tuberculin injection, and so consented to the change. His was, however, an interesting and exceptional case in more than one particular. His principal reaction came after the 6 mg. dose, when my attention was attracted to the characteristic rough respiration in the region of the *right* nipple, where before no abnormal sound was heard. This I have come to consider as symptomatic of the working of tuberculin in affected tissue, and is an additional diagnostic evidence which physical diagnosis alone cannot impart. Another interesting feature of this case was the seeming contraction, as the treatment progressed of the large cavity in the left lung, due to the shrinkage of the surrounding, and probably tubercular, affected tissues. My note of the fourth recorded examination, April 23, reads, "The case has gotten along very evenly, and a marked absence of tubercular change is manifest in an even average of pulse 94, respiration 26, and temperature $98\frac{1}{2}$ °. The cavity is, if anything, less in size, and moved upward and toward the front. The lung, while somewhat inactive below and behind, shows only a few coarse rales. This closing up tendency of the lymph when acting in lung tissue between the main bronchus and the lung periphery, is particularly applicable to the next case, No. 13, Rev. J. T. S., age 37, who had, he says, a contracted left lung, even in childhood, haemorrhage 7 years ago, pleurisy, 6 years ago, and la grippe, winter 1889-1890.

My diagnosis of his case, April 1, when I first saw him, was fibroid phthisis, probably third stage, left (because of a small honey-combed spot under left clavicle), and first stage right. I have no doubt the poor ventilation marked on his chart at the second examination,

April 6, over the lower half of the left lung, the air moving therin only a little except by forced breathing, was in no small degree due to the exaggerated reactions from the tuberculin injections which were manifest around the root of the left lung. I can conceive of tuberculin having this effect in a lung elsewhere unaffected, except around the largest bronchi. The previously contracted condition of this left lung in question aggravated the effect; and headache and chilly feelings were added to the usual evidences of a decided reaction, even to as little as 3 or 4 mg. I deemed it better, therefore, that measures should be inaugurated, chiefly left arm exercise, riding horseback, etc., which would tend to improve the use of this left lung, before proceeding farther with the Koch treatment.

No. 14 of the series, the wife of a prominent Chicago real estate owner, was also of special interest, but for reasons I have not seen noted by any other observer. The highest point reached in fifteen tuberculin injections was 9 mg., yet all decided reactions were accompanied by such temporary depression of spirits, with a chilliness, the second day afterward (she took them every three days), that a cessation was deemed advisable. However, the appetite was increased as was the ability to exercise, and the local effects were not at all unfavorable. Curiously enough her feeling of depression of spirits while on board ship at sea had been just the same.

The other six cases need also to have each a separate reference, in order to understand why eventually each should be classified under the doubtful cases for completing the tuberculin treatment. Every serious case has

some prominent feature about it which distinguishes that particular one from a thousand others.

Case 15, age 36, brick mason from Massachusetts; came with extensive fibroid process in left lung, probably caused by or following tubercular softening. This process increased and was made permanent, at different times after arrival in Colorado, by typhoid fever, pneumonia and by pleurisy. The strength of the fibroid tissue was shown by his pressure record on the manometer to be the normal for a man in health, 100 mm., while his spirometrical record was only 112 cubic inches, less than one-half of what it should be for a healthy man of his height. Nervous temperament, no fever, but bacilli in sputum. By the rule I will lay down the ratio of movement of the affected as compared with the unaffected side, namely, 1 to 3, with so small a spirometrical record, makes him an unfavorable case for tuberculin treatment. His case is in arrest. Nature and high altitude climate have already accomplished what tuberculin might perhaps have done. They work together on somewhat the same lines. Of course reactions, both local and general, followed, up to the limit of 6 mg., which was reached in his case. He, undoubtedly, had fibroid tissue enough and any increase through tuberculin injections was undesirable. He has since been doing first rate on mercurial injections over the hardened lung, while camping out at about 7,000 feet elevation in the mountains.

Case 16, a young man, age 20, from Scotland, a subacute case, diagnosed fibro-tuberculous, second stage, right, and first left. I believe the tuberculin treatment could not compass this case, for the principal reason

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which operates in many other serious cases, lack of ventilation of the chiefly affected lung, and also, in this case, because of a concealed septic state. Though 14 mg. were very gradually reached in the course of six weeks with some improvement, yet some times even a greater afternoon rise of temperature would be shown, 102.3° when the tuberculin had not been given than when it had. The abandonment of tuberculin and the substitution of iodine and chloride of gold and sodium injections for three weeks, greatly controlled the fever and he is now doing fairly well.

Case 17, I think was peculiar from the too great amount of elastic tissue in his expectoration, which followed a diminution in amount of sputum from 1 pint to 4 ounces per diem, during the first two weeks of tuberculin treatment. He was a blacksmith, age 35, from Omaha, Neb. His was diagnosed as a case of broncho-fibrosis, both lungs affected. Second stage right, and first, with large bronchiectasis left.

This case prompted the suggestion that it is possible excessively to stimulate the production of fibrous or elastic tissue, which is, of course, unadvisable in those already having enough. So, although bacilli in decreasing numbers were still found in his sputa tuberculin was discontinued at 12 mg.

Case 18, age 30, Secretary of a Cattle Company in Canon City, originally from Kansas for his health. A large cavity in left lung with some slight fibroid involvement of the rest of the left and part of the right lung. There was slight oozing of blood into the cavity, under one of the reactions, suggesting caution in advancing the treatment; and 12 mg. in a month was the highest point

reached. In his case, other than the cavity, there was decided local improvement—an increase and then a decrease in the number of bacilli to the field, an effect of treatment which was shown in nearly all of these cases.

Case 19.—A young man aged 24, from Kansas. Disease originally started from left pleurisy with effusion. February 17, before tuberculin treatment, the diagnosis was, left third stage, fibro-tuberculosis and catarrhal phthisis and right first fibroid. During the next four weeks 17 mg. the largest dose was reached. The patient increasing from $128\frac{3}{4}$ to 135 pounds in weight, and being very much encouraged by his ability to do and his general improvement. He then had an attack of what seemed to be la grippe, and no more injections were given. A week after this he was taken down with a very bad attack of measles. After ten days these accumulated poisons seemed to have centered in his left lung, which broke down rapidly, and he died one month after discontinuing the use of the lymph. I do not regret the course taken in this or any of the cases to whom tuberculin was administered, for accidents like that last mentioned could not be foretold, and the only disparaging claim that could be made would be that this young man was perhaps less liable to stand the peculiar poison of measles than if he had not been under the Koch treatment.

Case 20, much like No. 16, only worse as to febrile change and impossibility of thoroughly ventilating a contracted and partly honey-combed left lung. The pneumatic cabinet might have been of use in this case in counteracting the shrinkage effect of tuberculin in upper half of the affected left lung. This, as before explained, shuts in the stagnant air and perhaps the exuded bacilli

in the lung below; and such a case is not a good one for pushing the treatment.

On the whole, considering the very serious nature of the lung conditions in these, all of them tuberculosis cases, the result of the treatment is very encouraging, as proving tuberculin to be an important aid to climatic treatment in this region; or *vice versa* if you prefer it that way.

I ought perhaps to say that during this time, covered by my tuberculin experiments, I refused or decided not to give the Koch treatment to more than twice as many patients, partly because they were unsuited, but in a majority because they were incipient cases, especially suited to our climatic treatment.

[*Note, Feb. 1st '92.*] Up to the middle of June, '91, the above twenty cases were all to whom I had administered tuberculin excepting isolated cases, for diagnostic purposes. Since that time I have had about fifteen more tuberculin patients, better chosen for this aid to the climatic cure and hence with more uniformly favorable results.

These include several cases of large tolerated cavity in one apex the contraction or healing of which under tuberculin injections is being watched with much interest. In another case the tuberculin effect in shrinking and hardening of enlarged glands on the side of the neck, is manifest in a young lady in whom many bacilli were before treatment found in the sputum, but now none can be found. Of the cases under treatment and about graduated, previous to the time of presenting this paper the results have been very gratifying, especially is this the case with reference to Nos. 1, 4, 5, 6, 7, and 10. The gradual cessation of the treatment with a large dose

say once a week, seems to me to be indicated, and I have practiced this in leaving off at doses from 80 to 140 mgs.—C. D.

We have been asked or have ourselves desired, to use this newly discovered agent—tuberculin—with any very distinct understanding being granted us as to its composition, its strength or its mode of preparation. In view of reported adverse experiences and statements in reference to its use, this enforced uncertainty as to detail naturally suggests the inquiry. Would it not have been better to have submitted the first use of tuberculin, with all available information with reference thereto, to carefully selected experimenters for their separate determination of rules of procedure, and then from these sources, send out to the world reliable directions as to detail? As it is, we now hear of Prof. Koch reducing his initial dose in certain cases to one-tenth of his first promulgated order.

The advisability of the method employed for putting the tuberculin into use, was questionable, that is, its only being sold to hospitals. Of course one could use the friendship of the Secretary of the Interior, as I did, and get some of the "desired stuff," as he called it when he sent it to me. Nevertheless, the arbitrary restrictions to only hospital use, conjoined with the directions that patients should be put to bed when reacting to the lymph, was, I believe, a mistake. It was suggestive of the use of too large doses in too serious cases, and a lack of a right conception of what was desired to be accomplished. I started out to follow the direction with a private hospital of ten beds, but soon found it unnecessary for the kind of patients who do best under this treatment. To

be out of doors, riding on tramway or cable cars, even while gently reacting, was not hurtful, and my most satisfactory Koch patients were those who regularly exercised; as No. 1, who is a furniture polisher and has kept at his work ever since the first week of treatment; No. 2, who is all the time *on the go*; No. 5 ditto, whose expansion has increased to $4\frac{1}{2}$ inches; and Nos. 8 and 9, who, though reacting to less than one mg., have been averaging five to eight miles walking daily.

As to the details of the necessary examination, preliminary to commencing treatment with tuberculin, I have not time to give all the particulars. You can see my own examination chart which I here present; but I know that ordinarily some of the most essential points are omitted by the average medical man. Take the manometer, spirometer, and mensuration, for instance. The manometer, which gives information in millimetres of mercury of the strength of new elastic tissue formation in the lungs, is very seldom used; the spirometer, which has been depreciated by some of our best authors, the late Dr. Flint, Sr., for instance, is not one-tenth appreciated by the medical profession; I do not know that the bilateral movements of the chest are generally taken, and the same can be said of proper stethoscopic percussion for determining the commencement of softening or excavation of lung tissue. As I have made a careful use of these extra aids, to a proper understanding of these tubercular cases, I may perhaps be excused for referring to some thoughts which seem to me essential.

PRECAUTIONARY MEASURES AND RULES.

Understand the patient, the extent and character of his disease and its abridgement of his respiratory capacity

or the liability to such abridgement under this treatment. For this purpose compare the chest expansion and spirometrical record with the normal for his height; and if, as is most likely, the two sides differ in movement, compare the bilateral movements with the spirometrical record of this given individual. For instance, as in case 13 of my list, the movement of the left as to the right side was as one to three, and the spirometrical record 150 cubic inches, when it ought to be 250 for a healthy man of his height. Well, if we were to calculate that the right lung does its full share it would leave only 25 cubic inches for the left, or on the basis of one to three of what was breathed 37 cubic inches should be allotted to the left lung, and this only on forced breathing to the extreme. Of course this left lung was not ventilated. If there has ever been any softening in such a case and it has reached such a stationary stage, as to fever curve, that tuberculin would be otherwise safe to administer, then it must be that nature has been already at work through her own method of cure--the fibroid process. She has probably pasted up the lung by her plastic exudations of fibroid deposits, even to adhesions of that lung to the chest wall, so that the bacilli, though numbered by the million, lie embedded in natural prison vaults, almost effectually shut off from again invading the rest of the system.

Among the records of arrested phthisis in this rarefied atmosphere, we Colorado physicians have all seen this *natural* arrest. In fact, this fibroid process is so evidently Nature's chief reliance in all successful, as well as all fatal cases, that we are led to ask--how can arrest after softening of lung tissue occur without the aid of this natural method? Why, then, since the character of

auscultation sounds, and the method of healing caused by mild reactions to tuberculin are so similar to the effects of the fibroid process, only more accurate, why, I ask, should we go outside of natural causes to explain the curative process of Koch's lymph? It is entirely unnecessary. The lack of understanding of this matter is so queerly shown even by men of high repute.

Dr. Bristowe, who opened the late discussion of Koch's method in the Metropolitan Counties Branch of the British Medical Association, scouted at the idea that the bacilli were not killed but simply imprisoned "in an excess of inflammatory products," and Dr. Hector Mackenzie, equally antagonistic in his remarks, claimed that "Koch had led us to suppose that he had himself fully tested this wonderful remedy of his, that he had found that it prevented the growth of the bacilli in the test tube," etc. Dr. S. K. Jackson, of Norfolk, Va., in his late article on Tuberculin, read before the Section of Practice at the May meeting of the A. M. A., in Washington, entered into a lengthy argument to show that the bacilli *in situ* are killed by the introduced ptomaines of artificially cultivated bacilli, in accordance with a law which he had some time ago and several times since announced that "no organism can live in its own excreta." I say the test tube has nothing to do with a natural process like that we are discussing, and yet as for "poisoning" the bacilli in possession of the battle ground in the lungs, by their ptomaines introduced into the blood hypodermically, I believe it would be disastrous to the human body, to do such a thing. It does not seem reasonable to me that enough of the ptomaines diluted by the blood would reach the bacilli to poison them. Koch himself says they

are not destroyed. It is now perfectly clear to my mind that *that* is what does occur where Koch speaks of the "imprisonment of the bacilli" in inflammatory tissue, provided that *inflammation* is the proper term to use. But I am led to believe that Koch made a great mistake when he put it before the world that it was the "necrosis" (death) of the affected tissue which was effected, or ever desired to be effected. No, to kill the part, in order to destroy the enemy contained therein, would be such an aggravation, or rather perversion of the splendid healing process at the bottom of his discovery, that no one could gain an advantage from so doing, unless it would be Prof. Virchow, with his twenty-six post-mortems on bodies *de-funct* after tuberculin treatment. The renewal and healing of tissue affected is not to be brought about by the death (necrosis) of that tissue, which means its extinction. It is not *necrosis* that takes place or is desired, but a *stenosis* through the substitution of new material or the quickened action of Nature's fibroid process, in answer to a local demand. If it were not for an unusual cause, which is the tuberculin in the blood, nothing out of the ordinary would happen. But that which happens is unusual. Here I am led to a confession of faith, which is sufficiently strong to support me in the further use of tuberculin in my practice, though every other physician in America should pronounce against it.

It is a beautiful idea, abundantly verified as the law of Nature in her warfare with disease, that every living tissue, is endowed with a certain *power of protection* against injury, and repair for the same. This power is inherent in, and manifested in harmony with, the activity of the

life principle. So an acute injury of the delicate lung tissue, where the circulation of blood is five times as rapid as in the capillaries of the service of the body, must result in a correspondingly, greater systemic disturbance, and local demand for repair. Therefore, when an unused, poorly ventilated, catarrhally affected portion of lung becomes the congenial and fruitful abode of man's greatest enemy—the bacilli of tubercle—I believe the call is not unheeded by this independent thought of nature. The resources of the whole system are called upon to aid in the *burning out* of the enemy by combustion, drowning or *washing him out* in the rivers of catarrh, or *burying* him beneath or behind the ever-encroaching fibroid battlements. Where else will we find this protective influence more acute than at that point, especially in the lung, where the bacilli are lodged, and already surrounded by *these sensitive, protective elements?* It is not unreasonable to believe that the fibroid tissue which surrounds tubercular spots or ulcerations, and whose chief function and tendency is contraction, should be unusually susceptible to the ptomaines or juice of the bacilli, were these poisons to find their way there through the general circulation. I believe that this is the case, for I have several times with my stethoscope verified the contraction of fibroid elements in affected lung tissue under the special stimulation of tuberculin.

I know I shall be deemed delinquent in this article if I do not mention the action of the Philadelphia Commission and the Johns Hopkins College Hospital, in discontinuing the use of tuberculin because they were disappointed with their results.

As to the Philadelphia physicians, whom I highly esteem, I wish to say this: They were scrupulously following Prof. Koch's directions as to *dose* and *rules of confinement*. I am not. The character of the cases chosen at both the above trials were serious enough, notwithstanding a lurking suspicion in my own mind that had they properly tried stethoscopic percussion in some of their cases "with tubular breathing and moist crackling rales at an apex," they would have detected excavations *before the treatment*, instead of referring an advance in disease to the tuberculin injections. Of course, the contraction of affected tissues around a softened spot makes a small pre-existing cavity more evident.

The Johns Hopkins College Hospital failure is not to be wondered at. They could not surely have expected to have a miracle performed; for had they started out to damn the Koch treatment they could not have done so more effectually than by selecting such a bad lot of cases, housing them in an hospital, and giving them such large doses of tuberculin. Look at the list of the first eleven cases reported. Five of them with both lungs considerably affected; seven with large cavities, and the others with softening commenced or going on, *i. e.*, according to the physical signs noted in the first report. Had these cases been set loose in the open country during the time of the Koch treatment, and reached the maximum of 4 mg. instead of 12 to 20, they would probably have had enough for their needs and have done better. I cannot see that the essential precautions mentioned in this paper have been taken in any of the experiments thus far reported in the journals. The nearest approach to their

observance, which have furnished equally favorable results to my own, have been by Dr. Karl von Ruck, of Asheville, N. C. I was very glad to see from his late paper in the *Medical Record* that he had been working on much the same line as I had. I do not notice in his reports the extravagant general and febrile reactions so grossly exaggerated in newspaper reports of certain so-called "Koch hospitals."

CONCLUSIONS.

The following conclusions, however poorly elaborated in the body of this report, seem to me to be warranted at this stage of our investigations.

1. Tuberculin furnishes a natural method of cure, to be classed with stimulants, hypophosphites, exercise, high altitudes and cold, dry air; yet it is too powerful to be indiscriminately used, and the proportion of consumptives for whom its use would be advantageous remains to be determined.
2. It is unreasonable to expect that tuberculin will be useful in sepsis, or any poisonous blood state other than tuberculosis.
3. Use tuberculin not as a *substitute*, but as an *aid* to climate, and other natural methods of cure—proper food, hygienic surroundings, mountain climbing, etc. Especially are high altitudes and exercise indicated, if otherwise advisable, because they favor the ventilation of lung tissue, which is very necessary in giving tuberculin.

4. Seek only *local* reactions in the affected tissues. A high or prolonged febrile reaction is to be avoided, if possible. Use the minimum dose that will accomplish this purpose, and it is preferable to let at least a day

elapse between a subsidence of one reaction and the possible creation of another. Remember that an increase from $\frac{1}{4}$ to $\frac{1}{3}$ of a mg. may be as great for a case already reacting to the smaller dose as an increase from 30 to 40 mg. in a case that is far advanced in the treatment.

5. The lack of ventilation in a lung, whether caused by tuberculin already used or pre-existing, is a decided contra-indication to pushing the treatment, *i. e.*, according to this deficiency and the febrile state.

6. The test for the proper ventilation of a tubercular or fibro-tubercular lung is to be found in the comparison of the spirometrical record with the bilateral measurements of the chest and with available physical signs. A fair way to express deficient ventilation is to say, if the normal spirometrical record for the height is abridged one-half, and the movements of the two sides are as one to two, then there is sufficient lack of ventilation in the weaker lung for exercising extra caution as to using tuberculin at all. There is either too much elastic tissue already there, or the bacilli, if loosened by tuberculin, may not be expelled, but remain to infect the system, therefore due caution must be exercised in the selection of subjects for this method of treatment.

7. The stage of the lung disease has not so much to do with the question of using tuberculin at all, as has its extent and locality, the febrile course and the ventilation of the affected lung. If possible, have an average daily range of temperature of less than two degrees F. upon which to proceed, and the patient able to be much of the time in the open air.

8. The diagnostic value of small hypodermics of tuberculin is shown with or without febrile reaction in the

appearance on auscultation with a good stethoscope at suspected or affected spots in the lung substance, of a more or less decided *roughening of a previously existing broncho-vesicular respiration*; or a *high pitched, rude breathing* where before only a feeble respiration was noticed.

9. With the appearance of any unfavorable physical signs during the course of tuberculin treatment, such as a clogged up section of lung, or scattered moist rales suspicious of softening, I think it would be well to intermit injections of tuberculin and substitute those of iodine for a while, or to give temporarily syrup hydro-iodic acid compound or to use inunctions of oilate of mercury over the affected lung, until a return to the use of tuberculin is quite safe.

10. As to permanence of effects produced by tuberculin injections, *there is to me no apparent reason for expecting any more lasting results than from any other agency which will accomplish as much.* I do not see any reason why bacilli should not appear again in the sputum after their cessation under tuberculin treatment, as after their cessation under climatic change or the double chloride of gold injections. It is quite probable that the effect of tuberculin is temporary. We need not look for a guaranteed immunity from lung tuberculosis except under such other conditions of healthful living as would insure it.

11. In fine, tuberculin is not a remedy to be chosen for the great majority of pulmonary consumptives in preference to a proper change of life and climate, for it does not equal the latter; but with such a change, it is an important adjuvant to the cure of a large *selected* class of tubercular lung diseases.

